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# Northeastern Forest Experiment Station

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## WOODEN BEVERAGE CASES CAUSE LITTLE DAMAGE TO BOTTLE CAPS

*Abstract.*—Wooden beverage cases cause little damage to aluminum resealable caps during distribution. A study at bottling plants and distribution warehouses showed that an average of 1 bottle out of 4,000 has cap damage. Most of the damage was attributed to handling at the warehouse and in transit. Some recommendations are given for improvement of wooden beverage cases to prevent damage.

Wooden beverage cases used in distributing and storing soft drinks cause very little damage to aluminum bottle caps. This was revealed in a recent survey conducted by the U. S. Forest Service in cooperation with the Wooden Beverage Case Institute.

Soon after the introduction of aluminum screw-type bottle caps for use on returnable bottles, beverage-case manufacturers were told by bottlers that half-depth wooden beverage cases caused some damage to the bottle caps both when the cases were stacked upon one another in the bottler's warehouse and also during delivery. So our study was made to document the type and frequency of damage and to determine how seriously the damage affects the marketability of the soft-drink product. Half-depth wooden beverage cases and fiber and plastic cases were evaluated.

Four major soft drink syrup companies were surveyed, and data were taken from 15 of their franchised bottlers. Of the 15 bottlers, eight used half-depth wooden cases; five used half-depth fiberboard cases and one used full-depth fiberboard cases; and one used plastic cases.

In this study, we defined damage as that that required the removal of the bottle from the market. During our study, bottlers examined damaged bottles with us. They agreed that the seriously damaged bottles should not be placed on retail shelves for sale to the consumer.

### Half-Depth Wooden Beverage Cases

We collected data from eight bottlers who used half-depth wooden beverage cases. Of these, five used corrugated paperboard slip sheets between case layers to stabilize pallet loads and prevent damage to the bottle caps. The other three used no slip sheets.

The general data collected at these bottling plants did not define the frequency of the damage problem. Therefore we collected more detailed data at one bottling plant and one

distribution warehouse. The returned bottles whose caps were damaged during shipment were observed, recorded, and compared with total volume of shipments.

More than 430,000 bottles — about 18,000 cases — were observed at the one bottling plant and the distribution warehouse. Of these 430,000 bottles, we found 113 bottles damaged so that the product was not marketable. This figures out to 2.6 bottles out of 10,000 delivered to the retailer, or about one bottle per 160 cases. The damage was 0.0258 percent of the total number of bottles observed:

| *Source* | *Bottles observed* | *Damaged bottles* | *Type of damage observed* | | | | |
|---|---|---|---|---|---|---|---|
| | | | *Punctured* | *Twisted loose* | *Dented* | *Scarred or scraped* | *Total* |
| | *No.* | *No.* | *Pct.* | *Pct.* | *Pct.* | *Pct.* | *Pct.* |
| Bottler | 386,400 | 83 | 0.0114 | 0.0054 | 0.0039 | 0.00078 | 0.0215 |
| Warehouse | 52,224 | 30 | .0096 | .0306 | .0096 | .0077 | .0575 |
| All sources | 438,624 | 113 | 0.0112 | 0.0084 | 0.0046 | 0.0016 | 0.0258 |

Puncture damage occurred at about the same frequency at both bottling plant and distribution warehouse. On the other hand, damage due to caps twisting loose was about 6 times greater at the distribution warehouse than at the bottling plant; damage due to denting was about 2½ times greater at the distribution warehouse than at the bottling plant; and damage due to scarring or scraping was 10 times greater at the distribution warehouse than at the bottling plant.

The four types of damage occurred with the following frequency:

| *Type of damage* | *Frequency* | |
|---|---|---|
| | *Percent* | *No. of bottles* |
| Punctured | 43 | 49 |
| Cap twisted loose | 33 | 37 |
| Dented | 18 | 20 |
| Scarred or scraped | 6 | 7 |

Punctures made up the largest portion of the damage we recorded. We considered a cap punctured when there was a complete perforation of the metal cap and its liner, resulting in a release of carbonation. The fact that a delivery-truck driver frequently has no alternative but to slide cases is a contributing factor to this type of damage. We attributed more than 90 percent of this type of damage to exposed nails on the bottom of the wooden case.

We considered a cap twisted loose when it had been flexed or moved enough to break the seal or to loosen it from the bottle threads, resulting in a release of carbonation.

The fact that the delivery-truck driver slides and twists the cases during delivery definitely contributes to caps twisting loose. More than 80 percent of this type of damage was attributed to driver handling. Damage of this type was discerned mostly by observing the loss of fluid from bottles.

We considered a cap dented when there was a severe deformation or depression in it, the liner being cut, allowing a release of carbonation from the soft drink. The dents were caused by a blow or pressure on the cap during handling. Although we attributed 50 percent of this type of damage to case strapping and 50 percent to irregularities of the case bottom, the human factor as a cause of this type of damage should not be overlooked.

We considered a cap scarred or scraped when the lithograph on it was defaced and considerable bare metal was exposed, resulting in a general unsightly appearance. Consumer acceptance of the product rather than loss of carbonation was the determining factor in this case. We attributed about 80 percent

of this type of damage directly to friction from the bottom of the case during handling.

## Fiber Cases

We also collected data from five bottling plants that used half-depth fiberboard cases and one plant that used full-depth fiberboard cases. Cap damage that would make the product unmarketable could not be attributed directly to the fiber cases. The only damages that could be related directly to the fiberboard cases were minor scratches and dents that would not make the product unmarketable.

## Plastic Cases

Only one bottler who used plastic cases for handling returnable bottles was included in this study. Data from this bottler indicated that damage was not a problem.

## Summary and Recommendations

An average of only five bottles out of 20,000 are damaged. However slight, the problem of damaged caps does exist. Many factors influence the degree of damage experienced by a bottler who uses half-depth wooden beverage cases:

1. Care used in handling the product.
2. Number of handlings the product receives before delivery.
3. Distance from the production point to the sales point.
4. Highway conditions encountered during the delivery process.
5. Case-stacking practices — use of corrugated paperboard slip sheets.
6. Case condition — old or new.

The care used in handling the soft-drink product may be important in cap damage. Because of the nature of the product, more damage is likely to occur now than before. The soft aluminum caps now used are more susceptible to damage than the hard steel caps formerly used. So are the flat, narrow, fragile rims on the glass bottles now used as opposed to the former rounded, thick, fire-hardened rims. Consequently, the care that plant and delivery personnel exercise in handling the product will have a direct effect on the amount of damage. Rough handling probably will lead to greater damage.

The number of handlings and the distance from the production point to the sales point are essentially the same for all bottlers.

Highway conditions encountered during the delivery process vary from one bottler to another. When a bottler ships to a distant distribution warehouse for final delivery, both the number of handlings and the distance are increased. Poor road conditions also increase the amount of damage. As much as ten times greater damage occurs when the product undergoes increased handlings and is shipped over greater distances.

Case-stacking practices in the bottlers' warehouse and on the delivery truck varied. Bottling plants using half-depth wooden beverage cases were divided on the practice of using slip sheets between case layers. More than half the plants used some interleaving to stabilize pallet loads and prevent cap damage. Although no cap damage was experienced by bottlers who use slip sheets, this practice is both time-consuming and expensive. Bottlers who did not use slip sheets either repaired or replaced cases as required. These bottlers in effect were substituting good case condition for use of slip sheets.

Case condition is important. Our survey showed that half-depth wooden cases that are new or in good repair are less likely to damage bottle caps. More than 60 percent of all observed damage was caused by poor case conditions: exposed nails; loose strapping, and split, warped, or broken sides and bottoms.

Case condition should not be considered the only cause of damage. For instance, twisting loose of the caps was the second most frequent type of damage. This damage was more likely caused by a twisting or shearing action either in the handling of the case or a shifting of the entire pallet load while in transit. On the other hand, punctures, dents, scars, and scrapes may be attributed directly to the beverage case.

To minimize the cap damage related directly to the use of half-depth wooden beverage cases, we recommend:

1. That nails that have greater withdrawal resistance be substituted for nails now

used. Annular-ring or helically-threaded nails should be considered because of their much greater withdrawal resistance.

2. That more tension be applied to bands before nailing to ensure that the band is flush at the corners.
3. That the bands be recessed to greater depths than at present.
4. That a one-piece bottom with recessed holes be considered for case design.
5. That bottlers place increased emphasis on care in handling by plant and delivery personnel.

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